Analyzing the Effect of Nutrition Education on Snack Food Vending Choices of College Students

A Senior Honors Thesis

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Abstract

Over the last three decades, the U.S. has seen a steady rise in obesity. A commonly proposed solution to combating obesity is to provide nutrition education about healthy eating. While research in this area is on the rise, little to no research on education coupled with a policy that supports healthy snacking has been done on college students, many of whom are making basic snacking and meal decisions for themselves for the first time in their lives.

In this study, a pretest/posttest control group design was used to evaluate the impact of nutrition education on snack food choices in college students. Undergraduates enrolled in an introductory human nutrition class were the treatment group (n=71), and undergraduates enrolled in an introductory marketing course were the control group (n=76). Students in both groups were shown a photo of an actual vending machine and were then asked to select an item from the photo that they would choose given five different scenarios (meal replacement, meal supplement, craving, energy, and snack). Logistic regression models were used to evaluate changes in snack food selections between the treatment and control groups. Results demonstrate that students in the treatment group choose significantly healthier snack food choices for scenario 3 (craving, p=.0422) and scenario 4 (energy, p=.0013). From these results, we concluded that nutrition education may impact student snack choices in some situations.

CHAPTER 1

Introduction

Over the last three decades, there has been an alarming increase in the number of overweight and obese individuals in the United States. This epidemic has affected all age groups, from children to college-aged students to adults (1). This increase in weight has been measured by the Body Mass Index (BMI) (measure of the ratio of height-to-weight), with a BMI range of 25-29.9 defining the overweight population and a BMI above 29.9 defining the obese population. College-aged individuals (ages 18-23) have been reported to have overweight levels at 21.6% and obese levels at 4.9% as of 2002 (2). Further studies through 2006 have estimated these levels at 27% of college females being overweight or obese and 39% of college males being overweight or obese (3). This dramatic increase in weight is much more likely to have occurred consequent to a shift in behavioral factors, such as eating habits, as opposed to a shift in genetic factors (4,5,6,7).

The main behavioral factors that are affecting the obesity epidemic are increased sedentary lifestyles and increased consumption of energy, often from empty calories. The average American was eating approximately 400 more calories per day in 2006 than in 1977 (6). Prevalence of snacking has also increased nationwide, and according to a pilot study of vending machine use at The Ohio State University, 58% of college students chose the least-healthy snack options available to them (8).

One proposed solution to combat this growing problem is to implement nutrition education and policy initiatives. The Ohio State University implemented the point-of-purchase Snackwise® system for vending machines across its campus. Snackwise® color codes food items in vending machines based on nutrient density and places an explanation of the color

system on the vending machine where it is easily visible to consumers.

Another way that nutrition education has been used effectively is in the form of formal nutrition instruction in the classroom setting (9). In one study, researchers saw a significant increase in fruit and vegetable intake in college students enrolled in a basic nutrition class (10). Additionally, a second study found that college students with the most knowledge of nutritional guidelines were the most likely to actually follow these guidelines (11).

Despite the marked increases in BMI and prevalence of snacking, little research has been done on the effectiveness of nutrition education on influencing snack choice in the college setting. The impact of a formal nutrition education class on choice of snack food items among college students remains unknown. The purpose of this research is to determine if nutrition education (which includes how to use nutrition rating systems such as Snackwise®) impacts hypothetical vended snack food choices among college students on The Ohio State University campus. Specific research hypotheses include:

Ho: There will be no significant difference in the choices made by students who receive nutrition education.

H1: There will be significant differences in the choices made by students who receive nutrition education.

CHAPTER 2

Review of Literature

Overweight and Obesity

The number of overweight and obese individuals in the United States is increasing at an unprecedented rate, and college students are not exempt from this phenomenon (1). Using college students' self-reported height and weight, 17% of females and 28% of males were overweight and 10% of females and 11% of males were categorized as obese (3).

Snacking Prevalence

Data also shows that poor eating habits are common among college students. One survey of 736 students showed that nearly seventy percent consumed fewer than five servings of fruits and vegetables per day (2). Fruits and vegetables have often been replaced in the diet by nutrient-poor, energy-dense alternatives at meal and, particularly, snack times. A study at The Ohio State University showed that college students only chose the healthiest snacks at vending machines nine percent of the time (8). According to NHANES data, 86% of individuals snack on a daily basis, resulting in about 21% of total daily calories (5). Total energy consumed on a daily basis has also increased by 400 calories from 1977 to 2006, accompanied by the rise in the prevalence of snacking from 71% to 97% (6,7). In college students, specifically, one survey found that 20% of students typically eat morning snack, 54.4% percent typically eat an afternoon snack, and 72.8% typically eat an evening/late-night snack (12).

Cues to Eating

Specific situational cues (including living environment, convenience, time availability),

and internal factors (including age and stress) that drive snack choice in college students have been studied. One study found that 60% of upper classmen (juniors and seniors) ate an afternoon snack, compared to 47% of under classmen (freshmen and sophomores) which could indicate a lifestyle/living factor influencing this decision. Further, this study found that 54% of surveyed students reported that convenience was a main factor influencing food choice (12). In a study of Canadian college students, availability of time was also a deciding factor on food choice (13). Psychological and physiological factors may also have an impact on food choice (4).

In one study of 967 purchases at vending machines on a college campus by Klapheke et al (2011), the following fifteen "reasons for purchase" were discovered and summarized (17):

- Convenience
- Convenience-Location
- Convenience-Time
- Hunger
- Energy
- Physical Cue
- Emotional Cue
- Meal Replacement-Breakfast
- Meal Replacement-Lunch
- Meal Replacement-Dinner
- Snack
- Health
- Cost
- Craving
- Other

Interestingly, another study showed that stress and stressful situations had a significant impact on food choice. In this study at a Midwestern university, 272 college females were surveyed about levels of stress and their food choice during stressful times. According to the results, 80% of the students reported that they made healthy food choices 80% of the time. However, in stressful situations, only 33% of participants reported making healthy choices. In these types of situations, participants who had an increased appetite level chose sweet/sugary

items or “comfort” foods, such as desserts, candy, ice cream, burgers, pizza, tacos, and fast food (14).

Nutrition Education

In a study of 2280 Canadian undergraduate students, a point-of-purchase initiative was implemented to raise awareness of the healthfulness of some food items in a university cafeteria. Healthy foods (vegetable baskets, yogurt, pretzels, and fruit baskets) were heavily promoted over the course of six weeks. The increase in sales of yogurt and pretzels was statistically significant. According to Buscher, “a first step toward changing dietary habits may be to prompt people to make that first healthful snack choice” (16).

At this point in time, there are numerous ways that students can get nutrition information, and not all of it is from reliable sources. In a study by Davy at the University of Nebraska in 2006, college students reported the various sources from which they obtained nutrition information. 58.0% of college women reported obtaining nutrition knowledge from family members and 43.1% reported obtaining nutrition knowledge from magazines and newspapers. College men, alternately, were significantly different. 40.0% reported receiving nutrition information from family members and 30.5% reported receiving nutrition information from magazines and newspapers. Similarly, 46% of both college men and women reported receiving most of their nutrition information from a formal class (up from 33.5% in 1995) (9).

Other universities have also studied the effects of nutrition education on their students. In one urban campus, a nutrition education model was implemented during new student orientation for freshmen students. The 74-minute module included a PowerPoint presentation, discussion, and a game. After the module, the researchers conducted focus groups to determine the efficacy

of their module. Five focus groups were conducted with a total of thirty-four students. The focus groups found that most of the students learned something new from the module, a significant portion of the students "expressed an immediate interest in changing their current eating habits," and the students liked the "informal and friendly manner" of the graduate students teaching the module. They also determined that the students thought food models were the most effective at displaying appropriate portion sizes, but that the students thought the game, while fun, was not worthwhile (15).

Researchers at two northeastern universities utilized an internet survey to examine self-reported eating behaviors and their relationship to nutrition knowledge of 200 first-year college students. Only one-third of the students reported eating the recommended amounts of the five major food groups. It was found that students who consumed greater than the recommended amounts of fruit, whole grains, and dairy had greater knowledge than those who reported eating less than the recommended amount. For protein, those who ate less than recommended had the greatest amount of knowledge, while those who ate the most had the least amount of knowledge. According to Kolodinksy, "in every case, it appears that more healthful choices are made by those students with more knowledge" (11).

In a 2009 study at Kent State University, eighty college students were surveyed in a pre-test, post-test model after taking a fifteen-week general nutrition class. Participants completed a three-day diet record (two week days and one weekend day) and also participated in a fifty-minute interview to collect anthropometric data on the students. The average age of participants was 20.2 years, and the average BMI was 26.3. Results were statistically significant for the following consumption increases: total vegetables, fresh vegetables, total fruit, and fresh fruit. Results were statistically significant for the decrease in French fry consumption. According to

Ha and Caine-Bish, the lead researchers in this study, “class-based nutrition education may help college students translate nutrition knowledge into dietary behaviors” (10).

Nutrition Policy

Despite much research on the many nutritional policies implemented in grade schools, no research on the impact of nutrition and healthy food policies on college campuses has been done at this point in time.

CHAPTER 3

Methodology

Research Design

A pretest/posttest control group design was used to conduct this study. Students in an introductory nutrition class for non-majors served as the intervention group while students in an introductory non-nutrition class served as the control group. A ten minute survey was administered to both groups before and after the intervention.

Sample

The sample consisted of college students enrolled in an introductory human nutrition class (The Science of Human Nutrition 210 – treatment group) and those enrolled in an introductory non-nutrition science class (Foundations of Marketing Management 450). Enrollments for each class were 132 (HN 210) and 249 (BUSML 450).

Of these, 100 participants from the treatment group and 168 participants from the control group completed the demographic survey and pretest. Participants were screened based on responses provided on the demographic survey. Some participants (n = 121) were eliminated based on the following exclusion criteria:

- Participant had prior substantial knowledge on the subject of human nutrition
- Participant had already taken the treatment class (HN 210)
- Participant had already taken upper-level nutrition courses
- Participant did not give proper consent to participate
- Participant did not participate in both the pretest and the posttest

Final sample size after screening all participants was seventy-one students in the treatment group and seventy-six students in the control group.

These two classes were selected as the treatment and control environments for a variety of reasons. Students in Human Nutrition 210 were presumably not nutrition majors, as the class is a not a part of the nutrition major curriculums. It was assumed that students were taking the class to complete a GEC or elective requirement. Thus, it was expected that while the students likely had a slight demonstrated interest in nutrition, the only collegiate-level nutrition instruction they had received occurred consequent to this particular class. Students in Marketing 450 were, presumably, not nutrition majors as the course is not required for the nutrition major. It was expected that most of these students would not have had any collegiate-level instruction in nutrition. However, this course is required as a portion of the General Business minor, which nutrition students could potentially pursue, and the Nutrition in Industry major. The demographic survey asked participants to list their major(s), minor(s), and all nutrition courses taken at the collegiate level.

Instrumentation

The primary variable measured was vending choice given different specific scenarios. A ten minute test was administered to evaluate student snack food choices given different hypothetical situations. Five hypothetical scenarios were presented to all subjects in the treatment and control groups before (pretest) and after (posttest) the intervention. A PowerPoint slide with a photograph of an actual on-campus vending machine was displayed (see Appendix D). Students were asked, in a forced choice situation, to record their choice of vended snack food item for each of the five different scenarios. Based upon work by Klapheke (17), specific

situations include:

1.) *Conditions: Hunger, Meal Replacement*

"You are running late for class and did not have time to get something to eat. You are hungry, and you remember that there is a vending machine in the building where your class is located. You have enough money for any one item in the vending machine. Which item do you choose?"

2.) *Conditions: Hunger, Meal Supplement*

"You have a full day of classes, so you packed a lunch with you from home. When you sit down to eat, you realized that you didn't pack enough and you are still going to be hungry. You notice the vending machine nearby. You have enough money for any one item in the vending machine. Which item do you choose?"

3.) *Conditions: Stress, Craving*

"It has been a stressful day, and you are craving something to eat. There is a vending machine nearby. You have enough money for any one item in the vending machine. Which item do you choose?"

4.) *Condition: Energy Boost*

"You are running out of energy, but you still have one class left before you can call it a day. There is a vending machine in the building that your class is located in. You decide that a snack will help you make it through your class without falling asleep. You have enough money for any one item in the vending machine. Which item do you choose?"

5.) *Conditions: Hunger, Snack*

"You are hungry, but you have no snacks with you and won't have time for a meal for at least an hour. You come across a vending machine. You have enough money for any one

item in the vending machine. Which item do you choose?"

The photograph of the vending machine used during the pretest and posttest utilized the Snackwise® system for classifying the vending items into three categories: red (choose rarely), yellow (choose occasionally), and green (best choice). This system was implemented on Ohio State's campus three years ago. The colors are typically indentified in the vending machine by color coded clips on the individual spirals of snacks. For the purposes of this study, a colored line was graphically placed under each item in the photo because visually, some of the clips were not identifiable in the photo. Students in both groups could have potentially been aware of what the color coding meant due to prior experience (vending machines on campus had an explanation of the system on them), but only students in the treatment group received formal education about this system.

The Snackwise® system was developed by Columbus Children's Hospital and categorizes food items using eleven nutrients found on product food and nutritional labels: energy, total fat, saturated and trans fat, sugar, fiber, vitamin A, vitamin C, iron, and calcium. Items were then classified into three categories based on nutrient density: "green" items (eat freely), "yellow" items (eat occasionally), and "red" items (eat rarely). At the time of its inception through the time of this study, the ratio of "colors" in any given vending machine employing the Snackwise® system was 28.5-43-28.5 for red, yellow, and green, respectively.

Demographic data was also collected for all subjects, including: year in college, gender, age, height, weight, home country, and home state. Also, prior exposure to nutrition education was evaluated. Subjects were asked to report number of collegiate-level nutrition classes taken, number of nutrition classes taken outside the collegiate level, major, minor, whether the

participant learned about nutrition in high school, interest in learning about nutrition, interest in utilizing learned knowledge for personal betterment, and the frequency with which participants used sources of informal nutrition education (nutrition books, nutrition magazines, nutrition articles in the newspaper, healthy cookbooks, and nutrition resources on the internet) (See Demographic Information).

Methods

The intervention utilized by this study was the education provided by The Science of Human Nutrition 210 class. According to the syllabus, "this course meets the goals of the Natural Science component of the GEC. Courses in natural sciences foster an understanding of the principles, theories and methods of modern science, the relationship between science and technology, and the effects of science and technology on the environment. The specific learning objectives below that stem from the Natural Science Learning Objectives."

Lecture topics for the ten-week course included:

- Nutrient Classes, DRIs
- Protein
- Carbohydrates (including Fiber)
- Lipids
- Fat-Soluble Vitamins
- B-Vitamins
- Vitamin C
- Mineral Introduction
- Water, Electrolytes, Blood Pressure
- Calcium, Osteoporosis, Phosphorus
- Magnesium
- Iron
- Zinc and Copper
- Selenium and Iodine
- Other Minerals
- Phytochemicals
- Energy Balance
- Weight Loss Plans and Eating Disorders
- Weight Loss Aids and Underweight
- Diet Selection, Vegetarian Diets, Supplements
- Nutrition and Life Cycle

- Sources of Nutrition Information (Snackwise®)
- Food Labeling Laws
- Exercise and Athletics

Specific behavioral objectives for the course were:

Upon completion of this course the student should be able to:

1. Understand basic biological aspects of nutrient requirements of humans and appreciate the complex interactions and synergism of nutrients upon physiological processes and recognize the linkages between nutrients and disease processes, body size, and performance.
2. Understand some key events in the history of nutritional science.
3. Determine how nutritional information is derived from the scientific method of investigation, evaluate reputable versus non-reputable sources of nutrition information, and understand how the methods of modern science are used in the assessment of nutritional status.
4. Understand the diverse social and cultural patterns that influence food preferences and their implication to nutrient status and understand the potential of modern science and technology to address nutritional problems of the contemporary world.
5. Utilize computer technology to assess dietary intakes and activity levels.

Among general nutrition information, students in the treatment group were also presented with specific information related to maintaining energy balance and healthy snacking. The lecture, titled "Energy and Sources of Nutrition Information," included the breakdown of how many kilocalories per gram of each macronutrient, backgrounds on various nutrition professionals, and, most importantly, specific information on Snackwise®.

The following is the **exact** materials presented via PowerPoint to the treatment group by the instructor:

***Snackwise*®**

- *Program designed to help people make informed vending machine food choices*
- *Used in vending machines around campus*
- *The program ranks snack foods by nutrient density*
- *11 different parameters used to rank a snack (calories, fat, saturated and trans fat, sodium, fiber, sugar, protein, calcium, iron, and Vitamins A and C)*
- *Does not rank drinks*
- *Pros:*
    - *Color coded*
    - *Simplified nutrition information*
    - *Easy to remember (like a stop light)*
    - *In general, helps the consumer get more nutrients for her money*
- *Cons:*
- *The appropriateness of the food may depend on the situation (Sometimes it may be more beneficial to choose a red over a green)*
    - *Low blood sugar states (hypoglycemia)*
    - *Eating disorders (anorexia)*
    - *Athletes*
    - *Anemia (Example: Beef jerky is yellow)*

Study Procedures

This study was conducted during Winter Quarter of 2012. Approval for this study was obtained from the Social and Behavioral Sciences IRB on January 9, 2012. During the second week of class, the coinvestigator described the study to students in the treatment and control groups during scheduled class time. The consent form was reviewed with interested students, and those wishing to participate completed an informed consent form. Once informed consent was obtained, the pretest was administered followed by the demographic survey (See Appendices B and C). During the second-to-last week of class (ninth week), the posttest was administered to both the treatment and control groups.

Data Analysis

Demographic data was analyzed using a chi square test for statistical significance, using a p cutoff value of $p < .05$ for significance. Variables found to be significant were further analyzed by scenario. Those found to be significant were included in the analytic model. Responses to the pretest and posttest were compared and collapsed into two levels. They were then coded as either: Improve (red-to-yellow, red-to-green, yellow-to-green) and Regress/Stay the Same (red-to-red, yellow-to-yellow, green-to-green, green-to-yellow, green-to-red, yellow-to-red). Responses for each scenario were analyzed using a logistic regression model.

CHAPTER 4

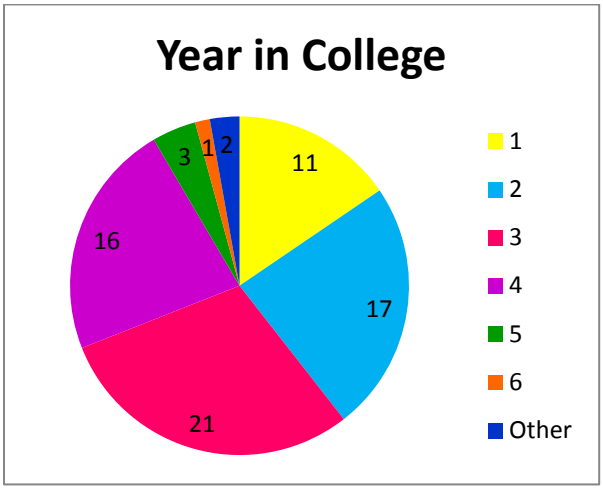
Results

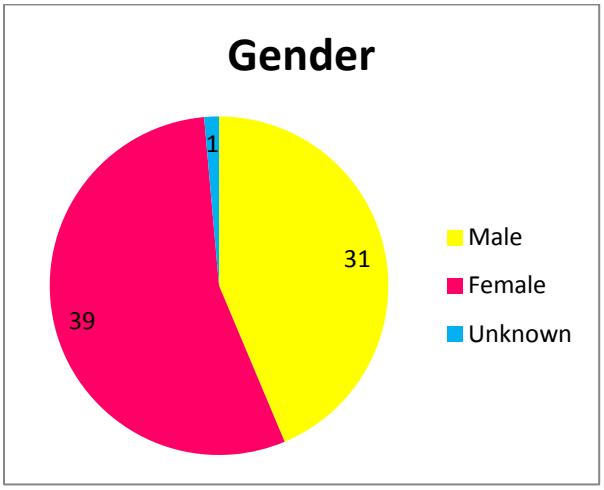
Demographics

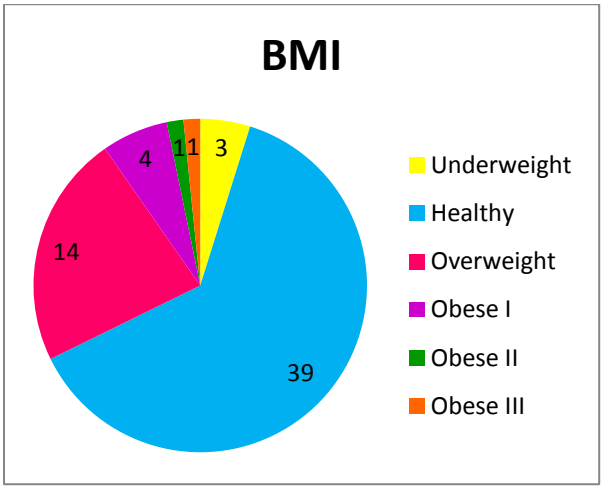
The demographics of the treatment and control groups are as follows:

Treatment Group

- Age: Range from 18-27, with the majority of participants (68%) falling between the ages of 19-22

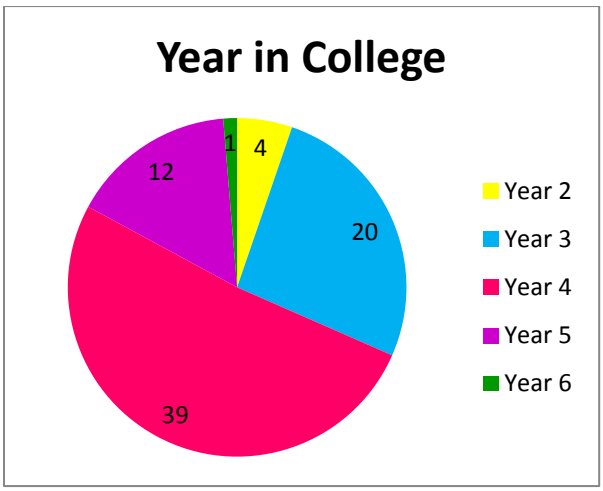


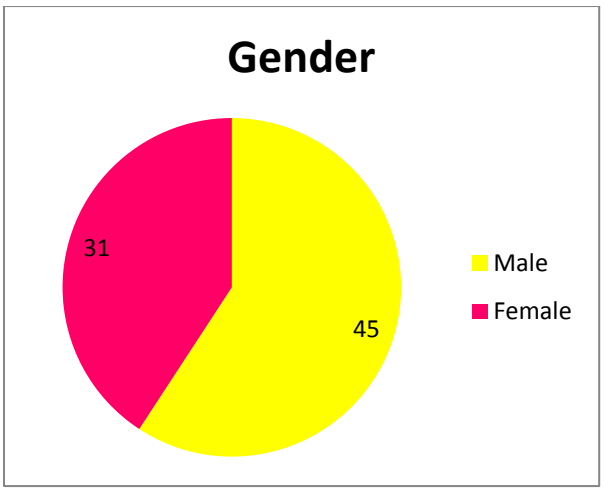


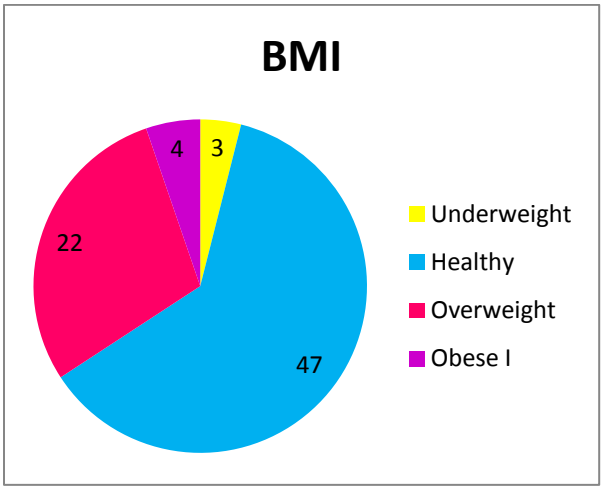


Control Group

- Age: Range from 19-25, with the majority of participants (95%) falling between the ages of 20-23.



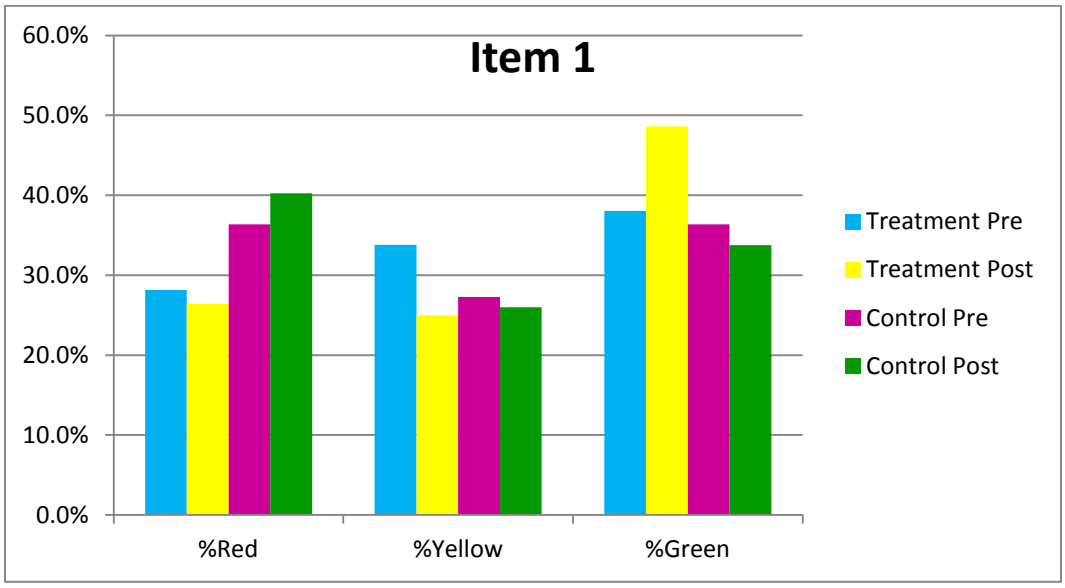




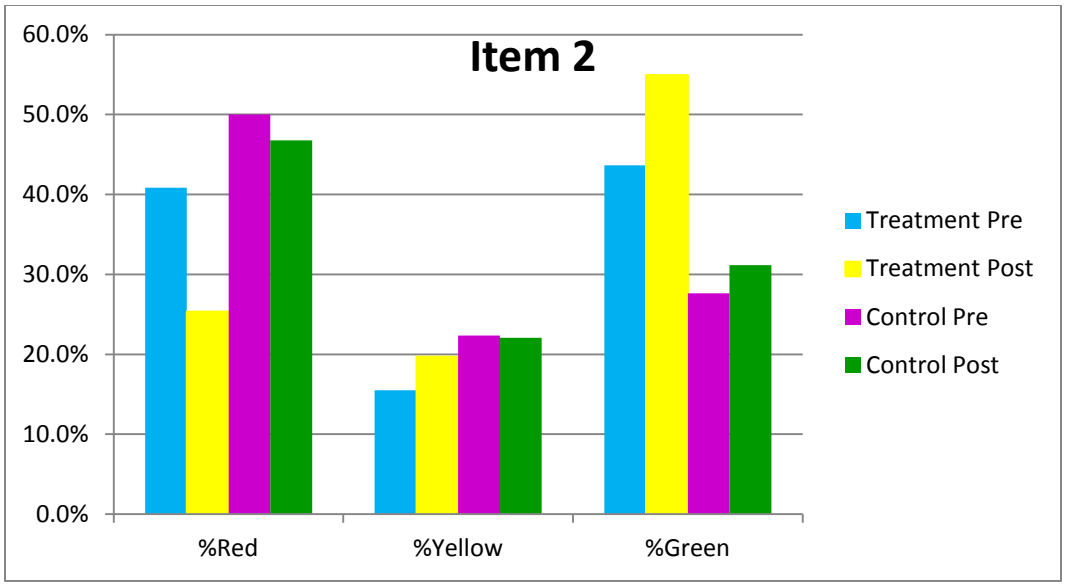
Initial analysis of demographic variables resulted in the determination that the treatment and control groups were similar except for age ($p = .003$), the participants' responses to the question "I am interested in learning about nutrition for my personal betterment: True or False" ($p = .0003$), and year in college ($p = .000001$).

Analysis

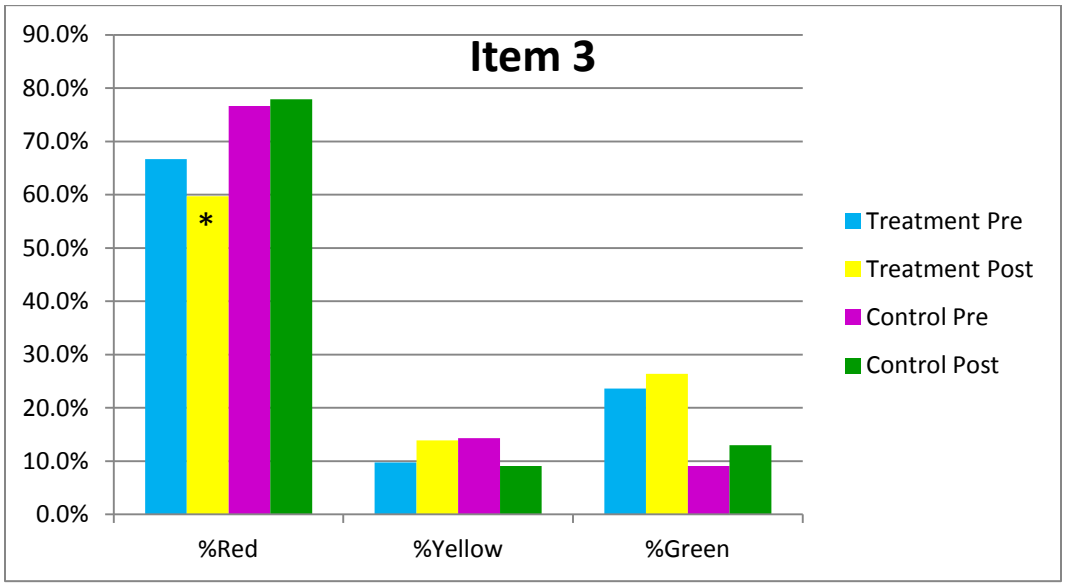
Descriptive Overview



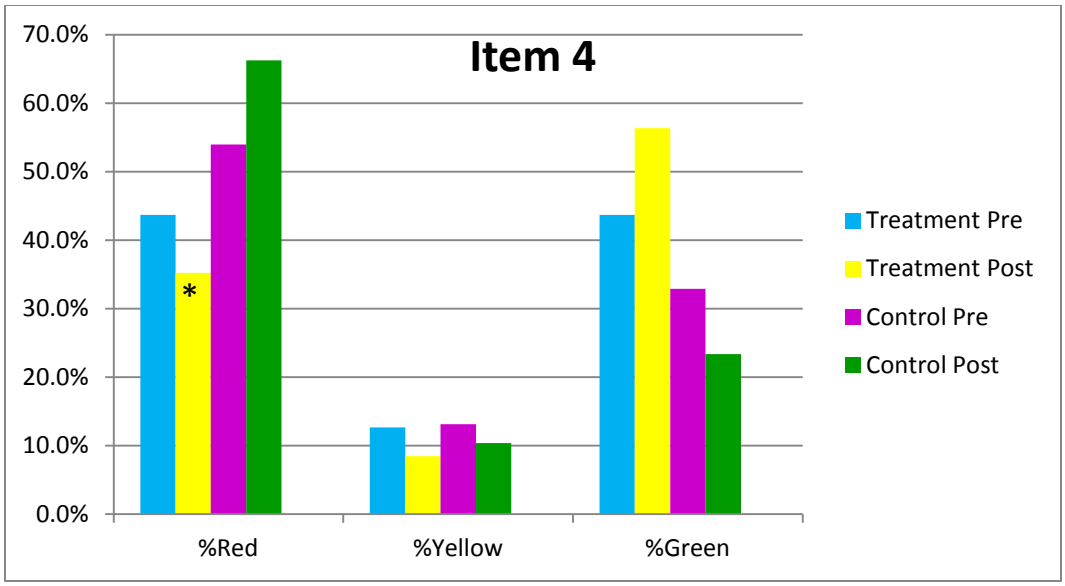
ABOVE: The treatment group chose fewer red and yellow items and more green items from the pretest to the posttest. Selection of red items decreased from 28.2% to 26.4%, selection of yellow items decreased from 33.8% to 25.0%, and selection of green items increased from 38.0% to 48.6%.



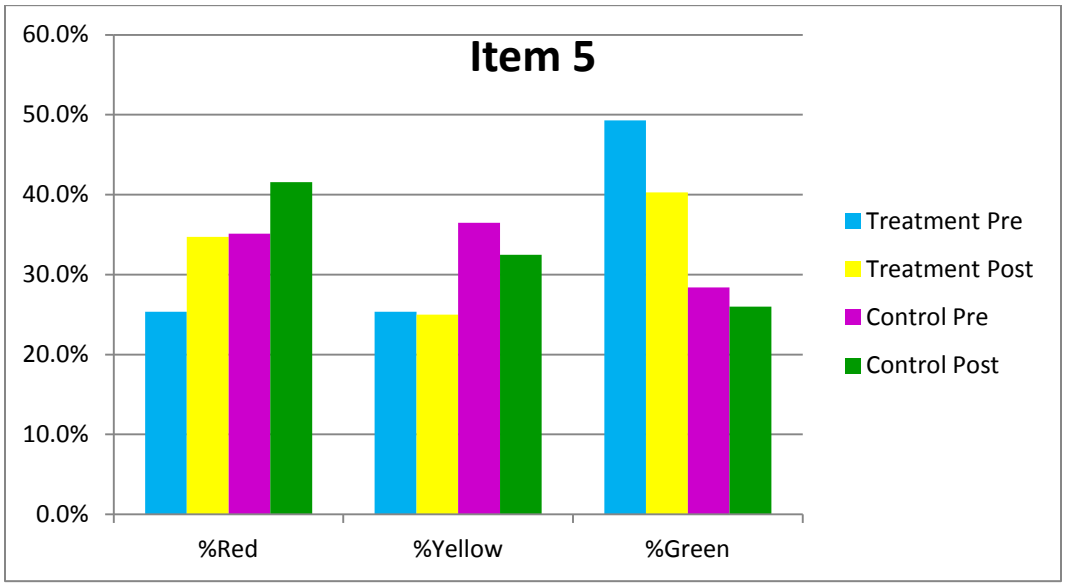
ABOVE: The treatment group chose fewer red items and more yellow and green items from the pretest to the posttest. Selection of red items decreased 40.8% to 25.4%, selection of yellow items increased 15.5% to 19.7%, and selection of green items increased 43.7% to 54.9%.



ABOVE: The treatment group chose fewer red items and more yellow and green items from the pretest to the posttest. Selection of red items decreased 66.7% to 59.7%, selection of yellow items increased 9.7% to 13.9%, and selection of green items increased 23.6% to 26.4%.

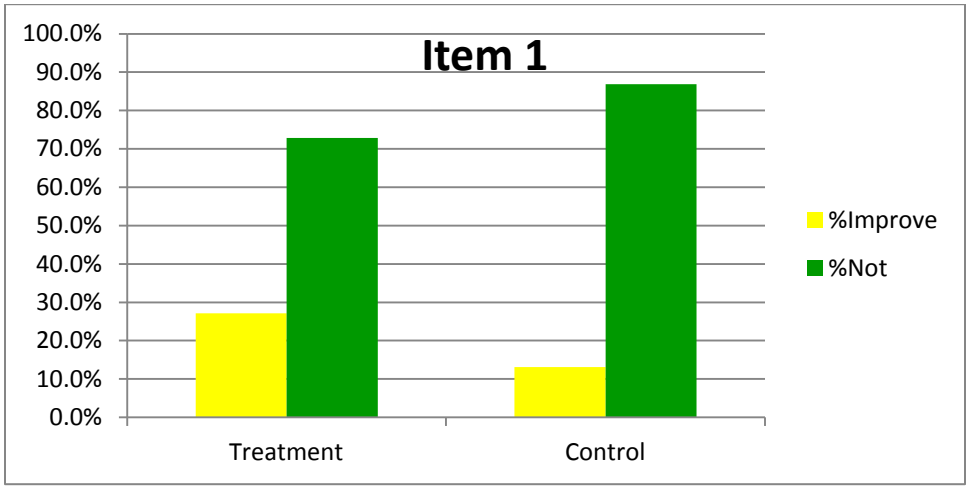


ABOVE: The treatment group chose fewer red and yellow items and more green items from the pretest to the posttest. Selection of red items decreased 43.7% to 35.2%, selection of yellow items decreased 12.7% to 8.5%, and selection of green items increased 43.7% to 56.3%.

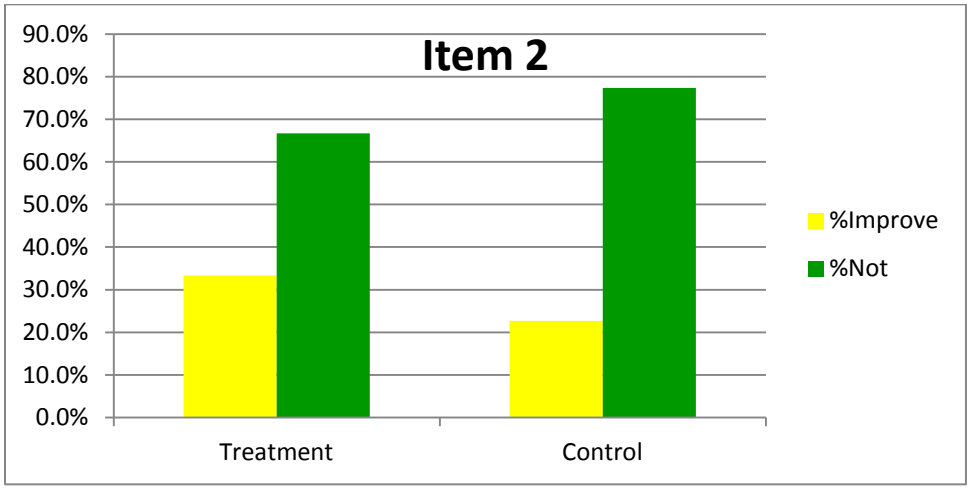


ABOVE: The treatment group chose more red items and fewer yellow and green items from the pretest to the posttest. Selection of red items increased 25.4% to 34.7%, selection of yellow items decreased 25.4% to 25.0%, and selection of green items decreased 49.3% to 40.3%.

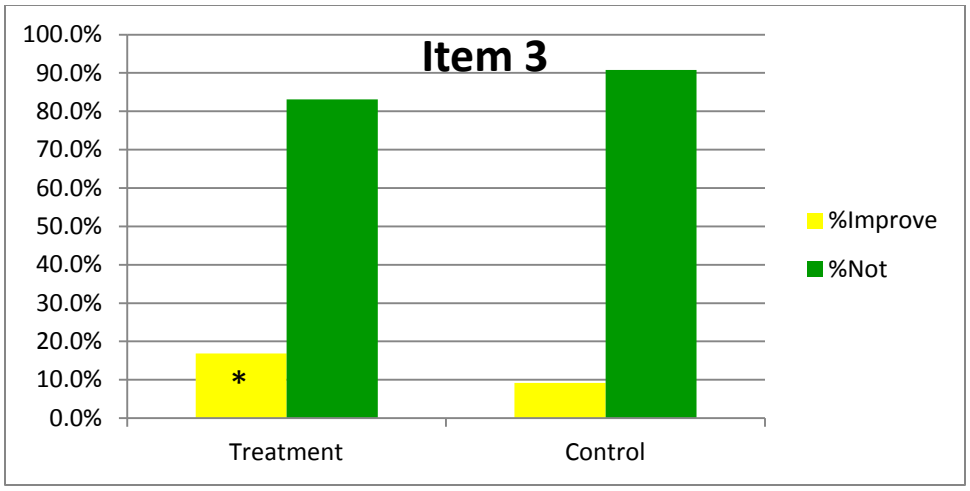
Logistic Regression



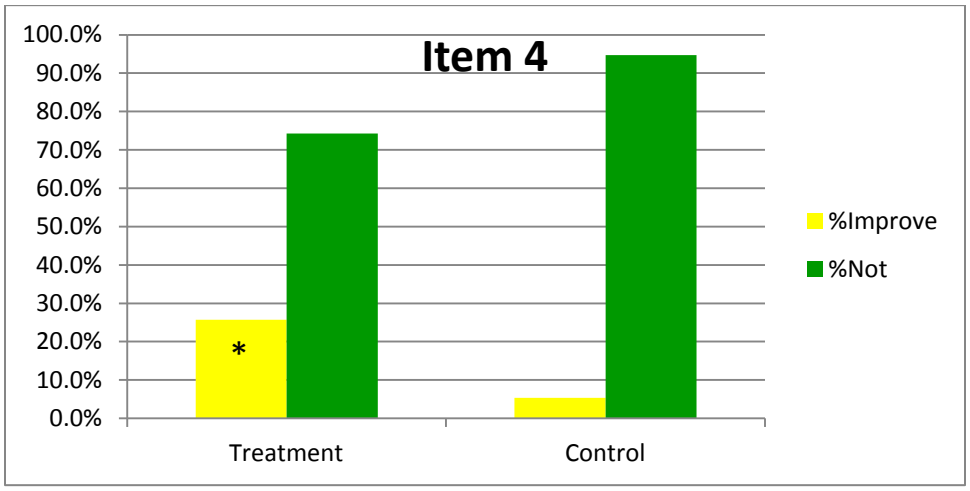
ABOVE: For scenario 1 (Conditions: Hunger, Meal Replacement) covariates included in the model for analysis were: age and whether or not participants took steps to gather information about nutrition for their personal use. Although 27.1% of participants in the treatment group improved, the treatment was not found to be statistically significant.



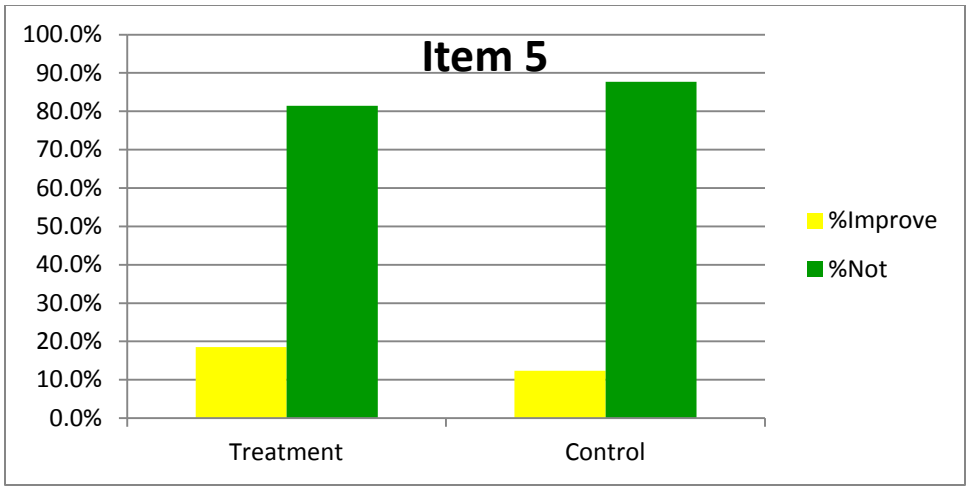
ABOVE: For scenario 2 (Conditions: Hunger, Meal Supplement), no covariates were included in the model for analysis. Although 33.3% of participants in the treatment group improved, the treatment was not found to be statistically significant.



ABOVE: For scenario 3 (Conditions: Stress, Craving), covariates included in the model for analysis were: year in college. 16.9% of participants in the treatment group improved, and the treatment was found to be statistically significant. However, year in college was also found to have a statistically significant (p = .04) effect on snack choice.



ABOVE: For scenario 4 (Condition: Energy Boost), no covariates were included in the model for analysis. 25.7% of participants in the treatment group improved, and the treatment alone was found to be statistically significant (p = .001).



ABOVE: For scenario 5 (Conditions: Hunger, Snack), no covariates were included in the model for analysis. Although 18.6% of participants in the treatment group improved, the treatment was not found to be statistically significant.

CHAPTER 5

Discussion

The proportion of students in this study who are overweight and obese is similar to other published data. 20% of the treatment group and 26% of the control group were overweight or obese. Given that BMI was calculated from self-reported height and weight data, it is possible that these numbers may be higher.

The effect of nutrition education was statistically significant in two of the five scenarios, scenario three (condition: stress, craving) and scenario four (condition: energy boost). This was very interesting for several reasons.

Green items were chosen the least (23.6%) by the treatment group in scenario three (compared to the other four scenarios) while red items were chosen the most (66.7%). Seventeen percent of students in the treatment group improved their snack food selection pretest to posttest. These results are similar to findings of Kandiah et al (2006) who found that college women were more likely to make healthy choices in non-stressful situations (80%) than stressful situations (33%) (14). It is encouraging that nutrition education significantly improved snack food selection under stressful circumstances. It is also worth noting that the posttest was conducted at the end of the quarter when students were approaching exam time, which likely put them in a more stressful mindset than during the pretest. Nonetheless, results still improved.

In scenario four, the largest increase in choice of green items by the treatment group was seen (a 12.6% increase). One of the "myths" the nutrition course attempted to correct is that sugary foods provide relatively more energy. An aim of this course is to demonstrate the benefits of consuming nutrient-dense items for energy instead. This may have contributed to our significant findings.

The results are similar to those reported by the Ha et al (2009) who found that students in a formal nutrition class were likely to make healthier choices after taking the class (10). They are also consistent with Kolodinksy et al (2007) who found that students with greater nutrition knowledge were more likely to eat healthy based on national recommendations (11).

Limitations

One of the major limitations of this study was the small sample size. The small sample size prevented us from examining reported changes in a more detailed fashion (example: participants who choose red items in the pretest and then a yellow item in the posttest is vs. participants who choose red items in the pretest and then a green item in the posttest). In our data analysis, we took a conservative approach to categorizing improvement. Persons that chose green in the pretest and then green in the posttest were assigned to the "did not improve" category, although the green to green decision is not necessarily a negative decision. With a much larger sample size, we could have utilized a multinomial logistic regression model and evaluated different levels of improvement or regression in snack food choice.

Another limitation of this study was the Snackwise® colors of the items in the vending machine. The machine was incorrectly stocked (i.e. items of one color were placed into spirals labeled as a different color) and faulty information was obtained from the vending company, leading the researchers to label several items in the vending machine "green" when they were yellow items. While three items were incorrectly categorized as green when in fact they were yellow (Lays Baked Chips, Nature Valley Granola Bars, and Trail Mix), results were analyzed as presented to the participants. Results may have been slightly different had the items been labeled correctly.

While we encouraged participants to respond honestly, it is important to note that respondents may choose to respond deceptively or inaccurately when self-reported data is collected. Similarly, scenarios were posted and study participants were asked to select the snack food they would choose. The "intent" to select an item may differ from items selected in actual settings, especially since we asked participants to make a forced choice. In reality, some participants may not have chosen a vending machine snack at all in the given scenario.

Implications for Future Research

Investigating the relationship between formal nutrition education in a classroom setting and actual snack food purchases from a vending machine and other sources would be a logical next step for further research. This will allow us to study the broader relationship between nutrition knowledge and food choice, since college students utilize many difference sources in addition to vending machines for snack food items. A larger sample size would allow us to investigate the changes made (i.e. red to yellow vs. red to green) in a more detailed fashion. Future research aimed at comparing different doses of nutrition education and improving food choice would also be useful to the fields of nutrition and public health. In this way, it can be determined if an entire course is necessary to elicit improved behavior or if a shorter, more time- and cost-effective nutrition education initiative can achieve the same results.

LIST OF REFERENCES

1. Hlaing, W., Nath, S. D., & Huffman, F. G. (2007). Assessing overweight and cardiovascular risks among college students. *American Journal of Health Education, 38*(2), 83-90.

2. Huang, T. K., Harris, K., Lee, R. E., Nazir, N., Born, W., & Kaur, H. (2003). Assessing Overweight, Obesity, Diet, and Physical Activity in College Students. *Journal Of American College Health, 52*(2), 83-86.

3. American College Health Association. American College Health Association - National College Health Assessment (ACHA-NCHA) Web Summary. Updated August 2007. Available at http://www.acha-ncha.org/data_highlights.html. 2007.

4. Eertmans, A., Victoir, A., Vansant, G., & Van, . B. O. (December 01, 2005). Food-related personality traits, food choice motives and food intake: Mediator and moderator relationships. *Food Quality & Preference, 16,* 8.)

5. Kant, A. and Graubard, B. (2006). Secular trends in patterns of self-reported food consumption in adult Americans: NHANES 1971-1975 to NHANES 1999-2002. *The American Journal of Clinical Nutrition, 84,* 1215-1223.

6. Duffey, K. J., & Popkin, B. M. (January 01, 2011). Energy density, portion size, and eating occasions: contributions to increased energy intake in the United States, 1977-2006. *Plos Medicine, 8,* 6.)

7. Piernas, C., & Popkin, B. M. (January 01, 2010). Snacking increased among U.S. adults between 1977 and 2006. *The Journal of Nutrition, 140,* 2, 325-32.

8. Caruso, M. (2010). Campus based snack food vending consumption. BS thesis. The Ohio State U., 2010. *Knowledge Bank.* Available at http://hdl.handle.net/ 1811/45650

9. Davy, S. R., Benes, B. A., & Driskell, J. A. (October 01, 2006). Sex Differences in Dieting Trends, Eating Habits, and Nutrition Beliefs of a Group of Midwestern College Students. *Journal of the American Dietetic Association, 106,* 10, 1673-1677.

10. Ha, E. J., & Caine-Bish, N. (March 01, 2009). Effect of Nutrition Intervention Using a General Nutrition Course for Promoting Fruit and Vegetable Consumption among College Students. *Journal of Nutrition Education and Behavior, 41,* 2, 103-109.

11. Kolodinsky, J., Harvey-Berino, J. R., Berlin, L., Johnson, R. K., & Reynolds, T. W. (August 01, 2007). Knowledge of Current Dietary Guidelines and Food Choice by College Students: Better Eaters Have Higher Knowledge of Dietary Guidance. *Journal of the American Dietetic Association, 107,* 8, 1409-1413.

12. Driskell, J. A., Kim, Y. N., & Goebel, K. J. (January 01, 2005). Few differences found in the typical eating and physical activity habits of lower-level and upper-level university students. *Journal of the American Dietetic Association, 105,* 5, 798-801.

13. Chapman, G. E., Melton, C. L., & Hammond, G. K. (January 01, 1998). College and University Students' Breakfast Consumption Patterns: Behaviours, Beliefs, Motivations and Personal and Environmental Influences. *Canadian Journal of Dietetic Practice and Research, 59,* 4, 176-182.

14. Kandiah, J., Yake, M., Jones, J., & Meyer, M. (March 01, 2006). Stress influences appetite and comfort food preferences in college women. *Nutrition Research, 26,* 3, 118-123.

15. Kicklighter, J., Koonce, V., Rosenbloom, C., & Commander, N. (2010). College Freshmen Perceptions of Effective and Ineffective Aspects of Nutrition Education. *Journal Of American College Health, 59*(2), 98-104.

16. Buscher, L. A., Martin, K. A., & Crocker, S. (January 01, 2001). Point-of-purchase messages framed in terms of cost, convenience, taste, and energy improve healthful snack selection in a college foodservice setting. *Journal of the American Dietetic Association, 101,* 8, 909-13.

17. Klapheke, A. (2012). A Comparison of Demographics and Purchasing behaviors of snack vending consumers at different locations at a large university. MS thesis. The Ohio State U., 2012.

Appendix A: Consent Form

The Ohio State University Consent to Participate in Research

Study Title:	**Analyzing the Effect of Nutrition Education on Snack Food Vending Choices**	
Researchers:	**Lead Researcher:**	Dr. Gail L. Kaye, College of Public Health
	Co-Investigator:	Nicole Brown, Department of Human Nutrition
		If you have any questions about this survey or study, please feel free to contact Dr. Kaye at kaye.3@osu.edu or Nicole at brown.3755@osu.edu.
Sponsor:	Department of Human Nutrition	

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.
Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this study is to determine what snacks you would choose at a vending machine given different specific scenarios.

Procedures/Tasks:
You will complete this short survey by answering what snack item you would choose at a vending machine in a given scenario. After that, you will answer some questions about yourself to help us better understand your answers.

Duration:
This survey should take no more than 30 minutes of your time. 15 minutes will be completed in class today, and 15 minutes will be completed in class at the end of the quarter. You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
There are no anticipated risks to you as a result of completing this survey.

Confidentiality:
Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:
No incentives will be provided for completing this survey.

Participant Rights:
You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:
For questions, concerns, or complaints about the study you may contact Nicole Brown at brown.3755@osu.edu or Dr. Gail Kaye at kaye.3@osu.edu.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Nicole Brown at brown.3755@osu.edu or Dr. Gail Kaye at kaye.3@osu.edu.

Signing the consent form
I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form**.**

Printed name of subject	**Signature of subject**
	AM/PM
	Date and time
Printed name of person authorized to consent for subject (when applicable)	**Signature of person authorized to consent for subject (when applicable)**
	AM/PM
Relationship to the subject	**Date and time**

Investigator/Research Staff
I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent	**Signature of person obtaining consent**
	AM/PM
	Date and time

Appendix B: Pretest/Posttest

Scenarios

Please refer to the photo of the vending machine on the projector screen for your answers to the following questions. Please only select one item from the photo. Please do not leave anything blank. Please be specific. For example, if you would like to choose "chips," please specify "Nacho Cheese Doritos."

1. You are running late for class and did not have time to get something to eat. You are hungry, and you remember that there is a vending machine in the building where your class is located. You have enough money for one item in the vending machine. Which item would you choose?

_____

2. You have a full day of classes, so you packed a lunch with you from home. When you sit down to eat, you realized that you didn't pack enough and you are still going to be hungry. You notice the vending machine nearby. You have enough money for one item in the vending machine. Which item would you choose?

_____

3. It has been a stressful day, and you are craving something to eat. There is a vending machine nearby. You have enough money for one item in the vending machine. Which item would you choose?

_____

4. You are running out of energy, but you still have one class left before you can call it a day. There is a vending machine in the building that your class is located in. You decide that a snack will help you make it through your class without falling asleep. You have enough money for one item in the vending machine. Which item would you choose?

_____

5. You are hungry, but you have no snacks with you and won't have time for a meal for at least an hour. You come across a vending machine. You have enough money for one item in the vending machine. Which item would you choose?

_____

Appendix C: Demographic Survey

Demographic Survey

Please answer the following questions honestly and thoroughly.

1.) What year are you in college?

1st Year 2nd Year 3rd Year 4th Year

5th Year 6th Year Other (please write in)_____

2.) Please list names/course numbers of all nutrition classes taken at the collegiate level.

_____

_____

3.) Please list names of the nutrition classes taken outside of the college or university setting.
(Example: Diabetes education course, community nutrition programs, high school nutrition classes.)

_____

_____

4.) Please circle the response that best describes you.

a.) I learned about nutrition in high school.
b.) I did not learn about nutrition in high school

5.) Gender (please circle one): Male Female

6.) Age (in years): _____

7.) Please list your major(s) and the college in which your major is found.
(Ex. Business Finance, Fisher College of Business.)

_____

8.) Please list your minor(s) and the college in which your minor is found.
(Ex. Business minor, Fisher College of Business.)

_____

9.) I am interested in learning about nutrition for my personal betterment: True False

10.) I take steps to gather information about nutrition for my personal use: True False

11.) The following are source(s) of informal education on nutrition. Please circle the response that best describes you.

a.) I have read nutrition books or I do read nutrition books.

Often Sometimes Rarely Never

b.) I have read nutrition magazines or I do read nutrition magazines.

Often Sometimes Rarely Never

c.) I have read newspaper articles on nutrition or I do read newspaper articles on nutrition.

Often Sometimes Rarely Never

d.) I have read/used healthy cookbooks that have an emphasis on nutrition or I do read/use healthy cookbooks that have an emphasis on nutrition.

Often Sometimes Rarely Never

e.) I have used the internet to look up articles and information related to nutrition or I do use the internet to look up articles and information related to nutrition.

Often Sometimes Rarely Never

12.) What is your home country? _____

13.) If you are from the U.S., what is your home state? _____

14.) What is your weight? _____

15.) What is your height? _____

Appendix D: Vending Machine Photo


all natural
popchips
sour cream & onion
potato
Lay's
Classic
all natural
popchips
barbeque
potato
Doritos
Nacho Cheese
Baked!
Lay's
ORIGINAL
CHEEZ-IT
Nature's Select
Toasted Soycrisp
BARBECUE
60
Protein
JACK LINK'S
PREMIUM CUTS
PRIME RIB
NABISCO
100
SNYDER'S
OF HANOVER
TWISTS
HONEY WHEAT
Stacy's
Pita Chips
CINNAMON SUGAR
Baked!
Lay's
70
Protein
JACK LINK'S
PREMIUM CUTS
TERIYAKI
BEEF
NABISCO
100
SNYDER'S
OF HANOVER
SNICKERS
Welch's
Reduced Sugar
Snack
TWIX
Reese's
Milky Way
Trident
95
1.50